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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/109,261	06/30/1998	GANG BAI	042390.P5769	3347

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EXAMINER

WARREN, MATTHEW E

ART UNIT	PAPER NUMBER
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2815

DATE MAILED: 09/10/2002

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

09/109,261

Applicant(s)

BAI

Examiner

Matthew E. Warren

Art Unit

2815

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133).
- Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 29 May 2002.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 8-21 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 8-21 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on \_\_\_\_\_ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- 11) ☐ The proposed drawing correction filed on \_\_\_\_\_ is: a) ☐ approved b) ☐ disapproved by the Examiner.  
If approved, corrected drawings are required in reply to this Office action.
- 12) ☐ The oath or declaration is objected to by the Examiner.

### Priority under 35 U.S.C. §§ 119 and 120

- 13) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).  
a) ☐ All b) ☐ Some \* c) ☐ None of:  
1. ☐ Certified copies of the priority documents have been received.  
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.  
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).  
\* See the attached detailed Office action for a list of the certified copies not received.
- 14) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. § 119(e) (to a provisional application).  
a) ☐ The translation of the foreign language provisional application has been received.
- 15) ☐ Acknowledgment is made of a claim for domestic priority under 35 U.S.C. §§ 120 and/or 121.

### Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449) Paper No(s) \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413) Paper No(s). \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

### **DETAILED ACTION**

This Office Action is in response to the Amendment filed on May 29, 2002.

#### ***Claim Rejections - 35 USC § 112***

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 8-12 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claims 8 and 15 include the limitation of the " first and second dielectric materials being scalable for a feature size technology having a gate length in the range 25-150 nm." The grammatical structure of the limitation makes the claim vague. It is not clear if the gate length refers to the feature size technology or to the first and second dielectric materials.

#### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claims 8-13, and 15-20, as far as understood, are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,963,810) in view of Nagata et al. (US 4,015,281) and Momose et al. (US 5,990,516).

Gardner shows (fig. 3D) a semiconductor device having a multi-layered gate dielectric formed directly on the substrate. The first dielectric layer (303) of the gate dielectric is formed on the substrate. The first dielectric layer is silicon nitride (col. 5, lines 25-44). The second dielectric layer of the gate dielectric is a high dielectric constant material (305) of BST (col. 3, lines 15-43) and is formed on the first dielectric layer. The dielectric constant of the first dielectric layer (SiN) is less than the dielectric constant of the second dielectric layer (BST). A gate electrode (307a) is formed on the multi-layered gate dielectric. Gardner shows all of the elements of the claims except the formula to determine the dielectric constant and the thickness of the dielectric being less than  $\frac{1}{3}$  the gate length. Nagata discloses in column 4, starting at line 40, an expanded formula to determine the dielectric constant. Momose et al. discloses (col. 2, lines 52-58) a semiconductor device in which the gate dielectric is less than  $\frac{1}{3}$  the gate length. The thin gate dielectric improves hot carrier reliability and ultimately the operating characteristics. The dielectric layers are inherently capable of being scaled because they have the same structure and materials as the claimed invention. The references do not disclose that the dielectric materials have a gate length in the range of 25-150 nm, however it would have been obvious to one of ordinary skill in the art to make the gate length within the desired range, since it has been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or

workable ranges involves only routine skill in the art. *In re Aller*, 105 USPQ 233.

Therefore it would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the gate dielectric of Gardner by using the formula disclosed by Nagata to determine the appropriate thickness of a bi-layered gate dielectric. It would have been obvious to also modify the gate dielectric of Gardner by providing the dielectric with a thickness in relation to the gate length. Momose teaches that determining the thickness of the gate dielectric with respect to the gate length helps improve operational characteristics.

Claims 14 and 21 are rejected under 35 U.S.C. 103(a) as being unpatentable over Gardner et al. (US 5,963,810) in view of Nagata et al. (US 4,015,281) and Momose et al. (US 5,990,516) as applied to claims 8 and 15 above, and further in view of Sato (US 5,258,645).

Gardner shows all of the elements of the claims except the third dielectric layer having a third dielectric constant. Sato discloses (col. 6, lines 49-58) a semiconductor device having a third insulating layer (12) formed as part of a tri-layered gate dielectric (17). The third layer (12) is silicon oxide and has a different dielectric constant than SiN and BST. The three-layer gate dielectric is formed to optimize the threshold voltage of the device and ultimately improve device characteristics (col. 4, lines 17-21). Therefore it would have been obvious to one of ordinary skill in the art to modify the bi-layer gate dielectric of Gardner by adding a third layer of dielectric material because Sata teaches

that a triple layered gate dielectric optimizes the threshold voltage of a semiconductor and ultimately improves the device characteristics.

### ***Response to Arguments***

Applicant's arguments filed with respect to claims 8-21 have been fully considered but they are not persuasive. The applicant primarily asserts that the cited references do not show all of the elements of the claims, specifically that the references do not disclose the gate length range as stated in the amended claims and the dielectric constant relationship as stated in the dependent claims. The examiner believes that the gate length of the device is not a critical element of the invention because it is only listed as a general parameter of the invention. The specification does not mention the necessity of such a parameter. Furthermore, the gate length is listed as a general range which is well known in the art for semiconductors. With respect to the limitations of claims 9 and 16, Gardner discloses that the first dielectric layer is SiN and the second dielectric layer is a high dielectric constant (high permittivity) layer of BST which each have known dielectric constants. As stated in the rejection, the dielectric constant of SiN is less than BST. Therefore, the cited references show all of the elements of the claims and this action is made final.

### ***Conclusion***

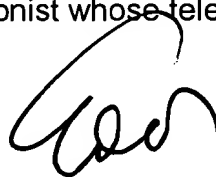
**THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the mailing date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew E. Warren whose telephone number is (703) 305-0760. The examiner can normally be reached on Mon-Thurs, and alternating Fri, 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie Lee can be reached on (703) 308-1690. The fax phone numbers for the organization where this application or proceeding is assigned are (703) 305-3432 for regular communications and (703) 308-7722 for After Final communications.

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the receptionist whose telephone number is (703) 308-0956.



EDDIE LEE  
SUPERVISORY PATENT EXAMINER  
TECHNOLOGY CENTER 2800

MEW  
*MEW*  
September 8, 2002